

Work to remove the soil from the top of the formerly closed, 32-acre section of the Denton landfill has begun. In May, the landfill mining operation starts.

RECYCLING THE LANDFILL

LANDFILL MINING PROJECT IN DENTON SHOWS POTENTIAL FOR FUTURE

Photos courtesy of city of Denton



As part of a feasibility study of the landfill mining project, researchers from UT Arlington and landfill workers dug several boreholes in 2014 and 2015 to determine the composition of the closed landfill space.

The future of waste management could be taking shape in North Texas thanks to the symbiotic relationship between the city of Denton, the University of Texas at Arlington, and the Texas Commission on Environmental Quality.

If the techniques being tested in Denton pan out as researchers at UT Arlington believe they will, the end result could considerably expand the lifecycle of landfills, recover valuable materials that have been wasted, produce more energy, and potentially create new uses for closed landfills.

These benefits revolve around the concept of landfill mining.

“The potential is exciting, but it is still too early to fathom the full implications,” says Matthew Udenenwu, a team leader in the TCEQ’s Municipal Solid Waste Permits Section.

For landfills that were active before local recycling programs began in earnest—which is the case at the once-closed portion

of the Denton landfill—there is great potential to capture valuable materials that were historically discarded. With between 200 and 300 closed landfills in the state, the potential for resource recovery and regaining land is huge.

“The process, if successful, would enable the use and reuse of a parcel of land over and over, making landfill land a renewable resource,” Udenenwu says. “The challenge for older landfill sites is that despite your best efforts to predetermine and classify the buried waste, you may still be surprised by unanticipated findings as you proceed with the activity. You don’t know what you don’t know.”

Developing technologies may help find out what is in sealed landfills, he says.

The Landfill Mining Project

Texas has two permitted landfill mining operations, one in Houston as part of a redevelopment effort, and the other at Denton’s landfill.

In the case of Denton, operators and researchers dug boreholes to determine the landfill's composition as part of a feasibility study in 2014, and again in 2015. Each time, they dug 50 feet into the landfill and sampled every 10 feet to develop an estimate of the kinds of materials it contained.

Besides discovering that the landfill had high levels of recyclables and unusually large amounts of dirt, the feasibility study



Photos courtesy of City of Denton



(Top) When boreholes were dug in the closed Denton landfill, samples were taken by UT Arlington researchers every 10 feet to help determine the landfill's composition. **(Bottom)** The closed Denton landfill was so dry that a newspaper from 1998 that was retrieved 50 feet down was completely legible.

showed that it was extremely dry, which explained why it produced so little methane for the landfill's electric generators.

A cost-benefit analysis showed that landfill mining would be beneficial at the Denton site, where work recently began to remove the soil from the top portion of the landfill in preparation for the

mining operation, which is scheduled to begin in May.

Even if the materials in the landfill had no value, the reality is that finding space for new landfills is only going to get more difficult and expensive as the population grows.

Vance Kemler, general manager of Denton's Solid Waste and Recycling Department, says that everything will eventually be removed from that old landfill space, which covers about 32 acres.

He estimates the site, which accepted waste from 1985 to the end of 2000, will gain about 60 percent more space once recyclables and usable dirt are removed. The remaining 40 percent of material will be returned to other active sections of the Denton landfill.

A processing station to sort recyclable materials will be set up during the landfill mining operation.

Large organic material, including wood and mattresses, will be processed through a grinder and shredder, which

was purchased thanks to a \$237,000 grant from the TCEQ that was awarded through the North Central Texas Council of Governments. Breaking down organic material in the grinder and shredder will accelerate decomposition and speed up methane

production when the materials are returned to active parts of the landfill.

After mining is finished, the department will test the old landfill's three-foot clay liner, which was required under pre-1993 regulations.

"We will see how well it has performed after thirty years," Kemler says, adding that the inspection "will provide good information for us, the TCEQ, and the rest of the industry."

Then the liner will be excavated, and a new liner, which will have a composite



Harvesting methane for energy is important to the Denton landfill. An enhanced leachate recirculation system takes the liquid that percolates out of the packed trash in the landfill and pumps it back through the waste to help break down natural materials. The result of this is an increase in methane gas production, which is a natural byproduct.

component and meet current environmental regulations, will be installed before the space is reopened to receive landfill waste.

"It makes good management sense to do that," says Kemler, noting that the new liner's technology protects groundwater better. "We are trying to be a better steward of the environment."

The Landfill of the Future

The Denton project is part of a grander goal envisioned by Dr. Sahadat Hossain, a UT Arlington civil engineering professor and director of the university's renowned Solid Waste Institute for Sustainability, which has been working closely with the



Sahadat Hossain, a University of Texas at Arlington civil engineering professor, has worked with the city of Denton on several research projects at its landfill.

Photo courtesy of UT Arlington

Denton landfill on a variety of projects. In return for technical assistance, the landfill has made itself available for research by UT Arlington professors and graduate students.

The relationship has been in place for years and has resulted in a handful of dissertations focusing on innovative projects at the landfill, such as a technique to measure and maintain consistent moisture throughout a landfill space to better facilitate methane production.

Researchers and landfill professionals from around the world have visited the Denton landfill with UT Arlington professors to see what is being done there.

The hope is that Denton's landfill project will help determine the feasibility of landfill mining for the industry and create more efficient and sustainable waste management practices.

"We just happen to be a facility that has the greatest opportunity to try out landfill mining" because of the proximity to the UT Arlington institute, Kemler says. "We are excited about it. It may open doors in the future to make TCEQ and the industry consider landfill mining."

Hossain wants the term, *landfill*, to eventually become antiquated. Just as the word, *dump*, is offensive to many in the landfill business because it suggests the unregulated disposing of trash, Hossain sees the term, *landfill*, as meaning locking away waste safely indefinitely.

Instead, he says the terms, *waste management facility* or *materials management facility*, should be applied to regulated disposal sites of the future because little would be wasted. For a landfill designed to handle waste for 30 years, landfill mining suggests that its



Methane collected at the Denton landfill is transferred to an onsite 1.6-megawatt electric power generator system, which sends enough electricity back to the municipal utility company to power about 1,600 homes daily.

lifespan could be extended to 150 years or more, Hossain says.

He adds that a landfill would need at least four cells that would be rotated. Each cell would be active for seven and half years before being temporarily capped. In this scenario, organic material would be ground and shredded before it entered an open landfill cell, and leachate (liquid that accumulates within the cell) would be recirculated. The closed cells using this method would produce high amounts of methane, and the organic material would be fully composted within 10 to 15 years.

After the composting period, any remaining recyclable materials would be processed, residuals removed, and the cell would again accept new waste.

Hossain says the composted material that is removed would still have 50 percent remaining organic matter that could be converted into pellets for use as an energy source. He says some countries, including Austria and Denmark, use landfill pellets as fuel at their local electric utilities.

"You don't close the landfill anymore," Hossain says. "That's the intent in Denton.

We want to keep using the same space again and again. We are recycling landfill space over and over."

These techniques will appeal to the waste management industry as a whole because, ultimately, it means squeezing as much profit out of a landfill space as possible.

"If you show them the money, they will work on it," Hossain says.

Udenenwu says if landfill mining and the techniques Hossain and other UT Arlington researchers are developing in Denton catch on, the permitting process for landfills would likely need to change.

"We currently have composting as a potential analogue of the possibilities of landfill mining," Udenenwu says. "Landfill units may very well become long-term composting units, but we don't know yet; it will all depend on the market."

With the state's population steadily increasing and land values continuing to trend upward, economics suggest that finding more efficient ways to use landfill space is not a case of *if* but *when*. 🌱

UT Arlington Video: "A Landfill with a 200-year Lifespan"
www.uta.edu/news/video/2016/01/landfill-mining-international-school.php



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